Interview Summary	Application No.	Applicant(s)	
	10/666,129	MUNEKATA ET AL.	
	Examiner	Art Unit	
	Sikyin Ip	1793	

All participants (applicant, applicant's representative, PTO personnel):

(1) *Sikyin Ip*.

(2) *Michael Tobias*.

(3) S. HIROSE

(4) Y. Toyoda

(5) F. Imai

Date of Interview: *09 October 2007*.

Type: a)☐ Telephonic b)☐ Video Conference
c)☒ Personal [copy given to: 1)☐ applicant 2)☒ applicant's representative]

Exhibit shown or demonstration conducted: d)☒ Yes e)☐ No.
If Yes, brief description: attached

Claim(s) discussed: *All*.

Identification of prior art discussed: *All*.

Agreement with respect to the claims f)☐ was reached. g)☐ was not reached. h)☐ N/A.

Substance of Interview including description of the general nature of what was agreed to if an agreement was reached, or any other comments: *.

(A fuller description, if necessary, and a copy of the amendments which the examiner agreed would render the claims allowable, if available, must be attached. Also, where no copy of the amendments that would render the claims allowable is available, a summary thereof must be attached.)

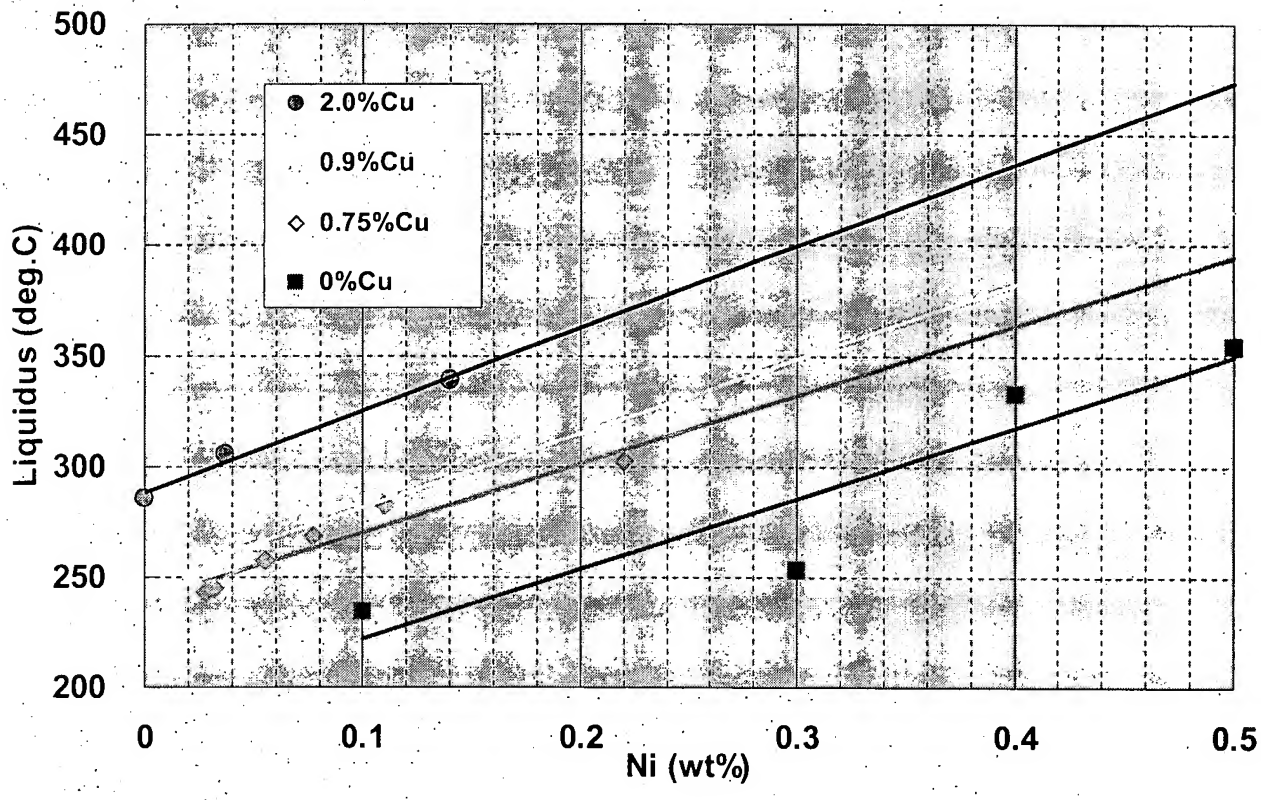
THE FORMAL WRITTEN REPLY TO THE LAST OFFICE ACTION MUST INCLUDE THE SUBSTANCE OF THE INTERVIEW. (See MPEP Section 713.04). If a reply to the last Office action has already been filed, APPLICANT IS GIVEN A NON-EXTENDABLE PERIOD OF THE LONGER OF ONE MONTH OR THIRTY DAYS FROM THIS INTERVIEW DATE, OR THE MAILING DATE OF THIS INTERVIEW SUMMARY FORM, WHICHEVER IS LATER, TO FILE A STATEMENT OF THE SUBSTANCE OF THE INTERVIEW. See Summary of Record of Interview requirements on reverse side or on attached sheet.

Applicants showed experimental results regarding unexpected effects
Applicants will submit amendment and CFR 1.132 declaration
regarding experimental results.

Examiner Note: You must sign this form unless it is an Attachment to a signed Office action.

Examiner's signature, if required

Fig.6 Liquidus of Sn-Cu-Ni-P



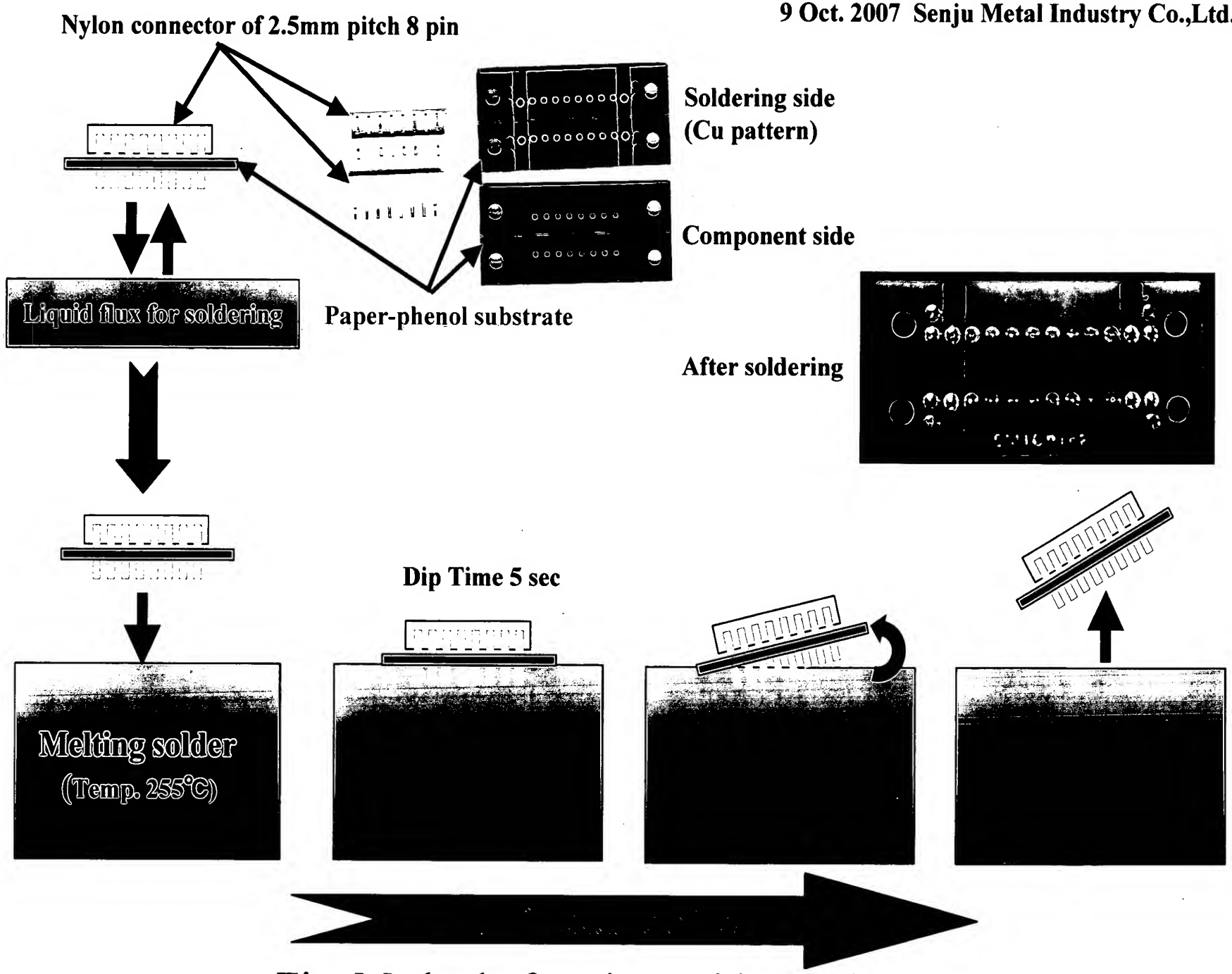


Fig. Method of testing Bridge and No-wet

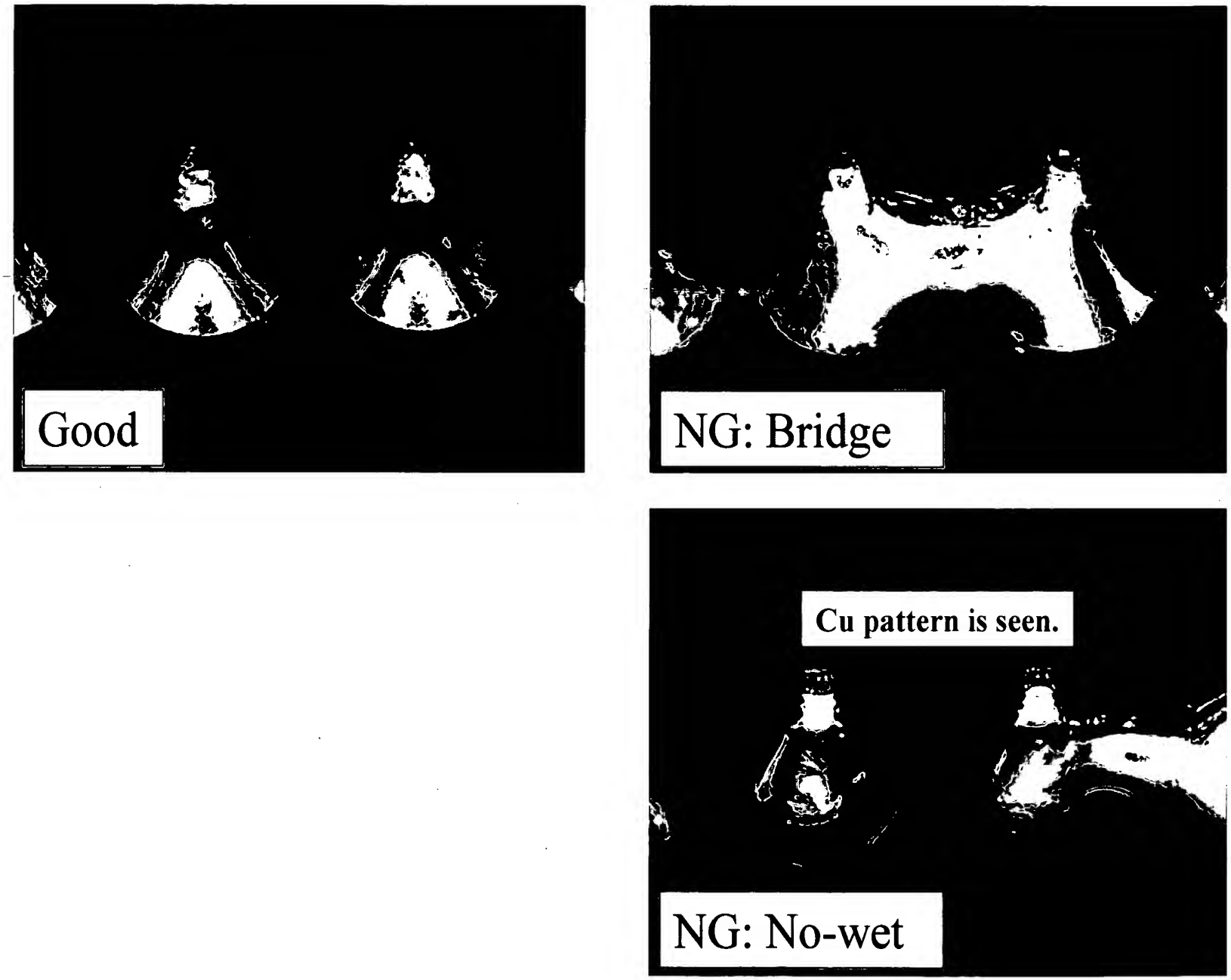
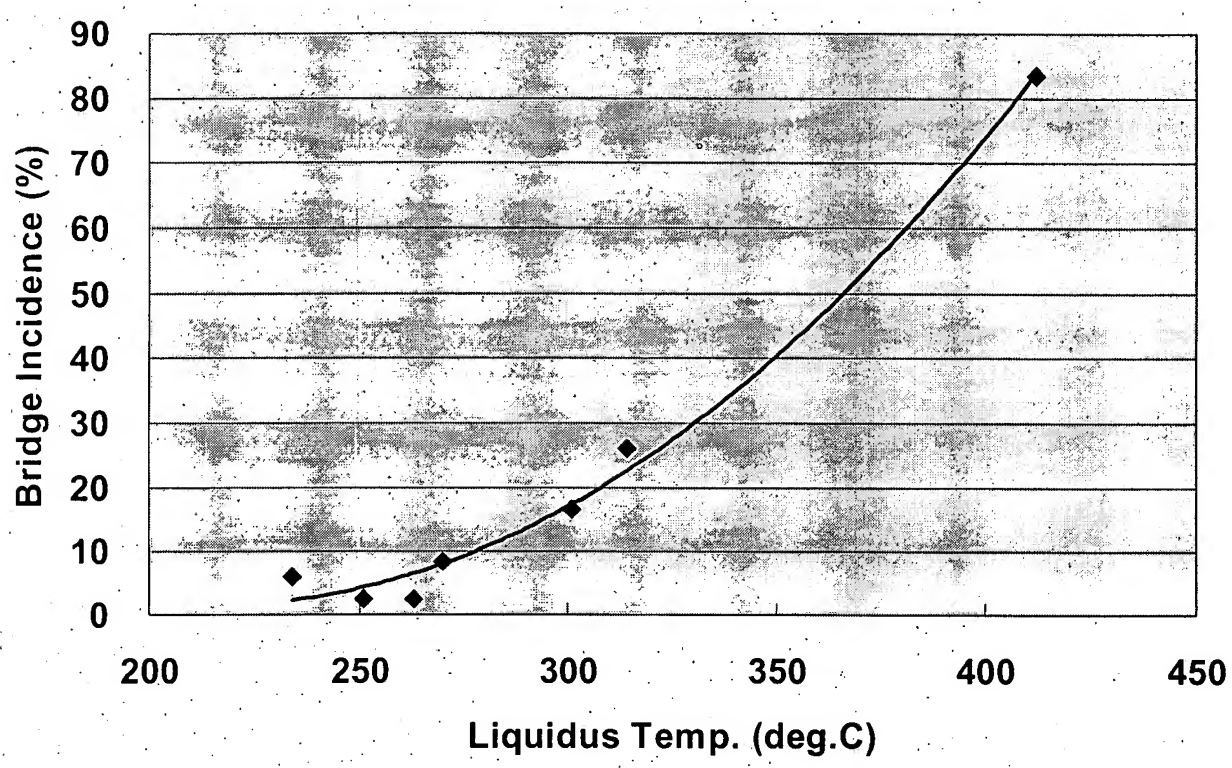


Fig. Method of testing Bridge and No-wet

Fig.3 Bridge vs Liquidus



Problems of JP 10-144718

- Liquidus temperature is too high for reflow soldering
- Liquidus temperature is too high for flow soldering
- Would cause bridging and unwetted portions in flow soldering
- Would cause needle-shaped IMC in flow soldering

Special effects of this invention (Sn-Cu-Ni-P Alloy)

- Excellent wettability
- Low cost compared to Sn-Ag-Cu alloys
- Low incidence of bridging
- Low incidence of dewetting
- Low incidence of needle-shaped IMC

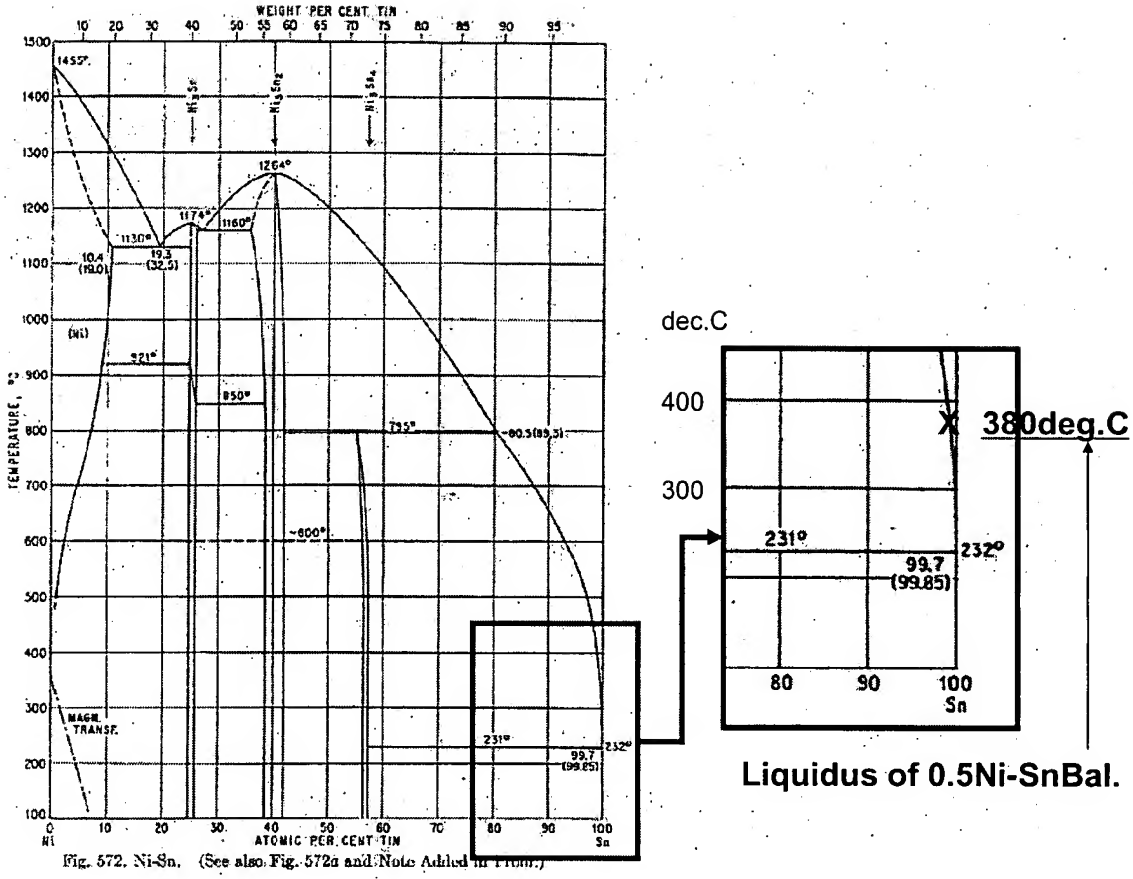


Fig. 572. Ni-Sn. (See also Fig. 572a and Note Added in Proof.)

Fig. Phase Diagrams of Sn-Ni

Fig.4 No-wet vs Liquidus

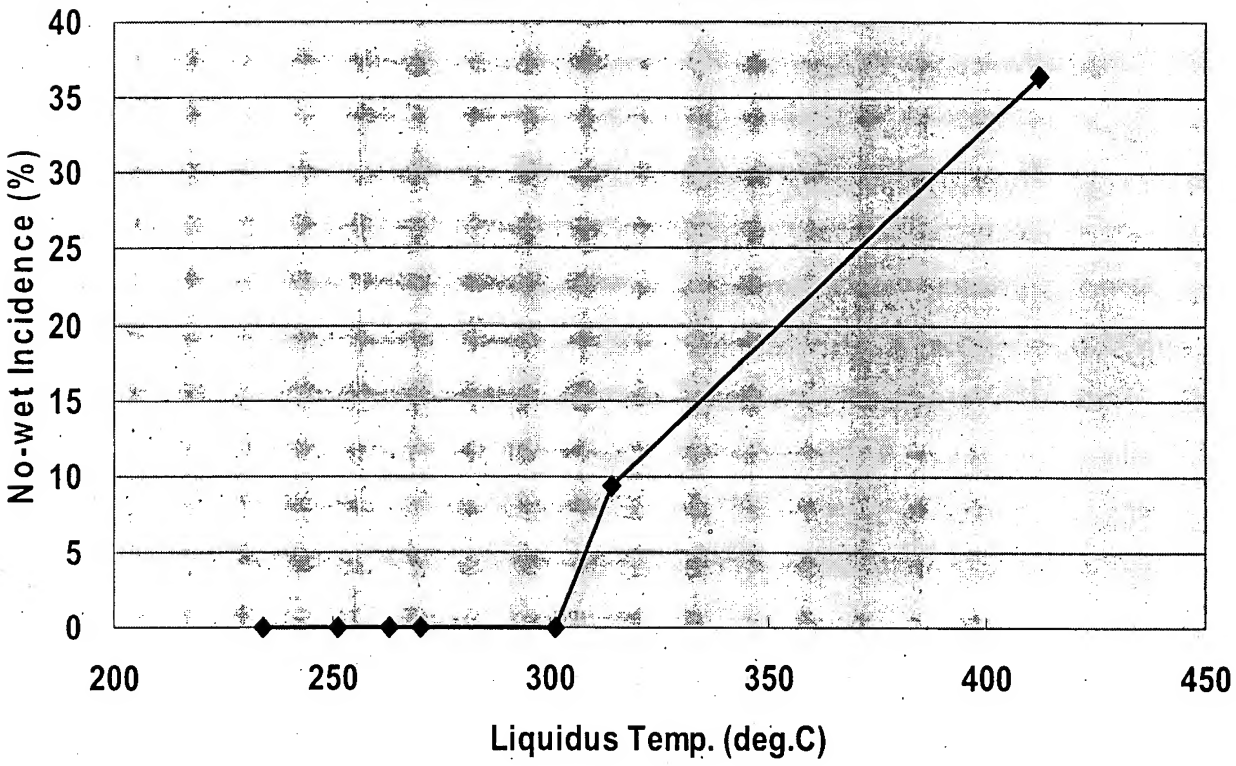
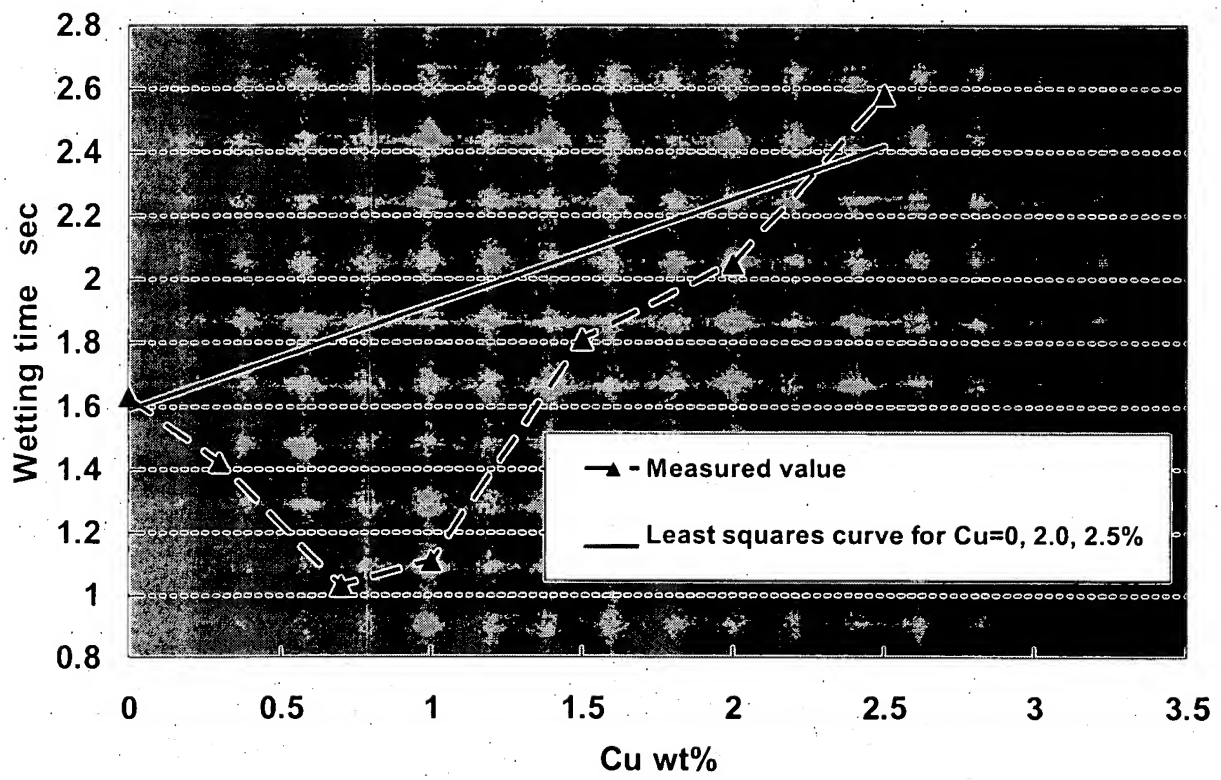


Fig. Wetting time of Sn0.05Ni0.003P+Cu Alloy



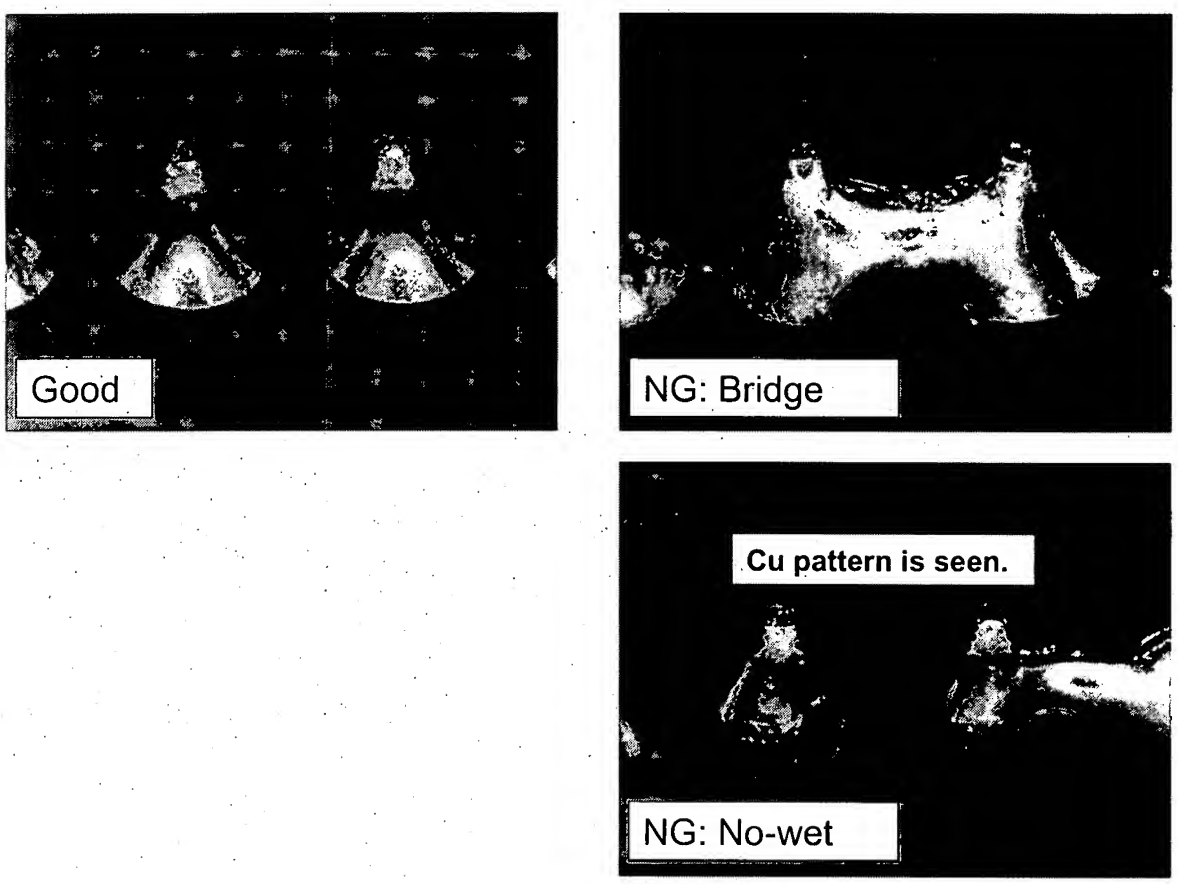


Fig.2 Method of testing Bridge and No-wet

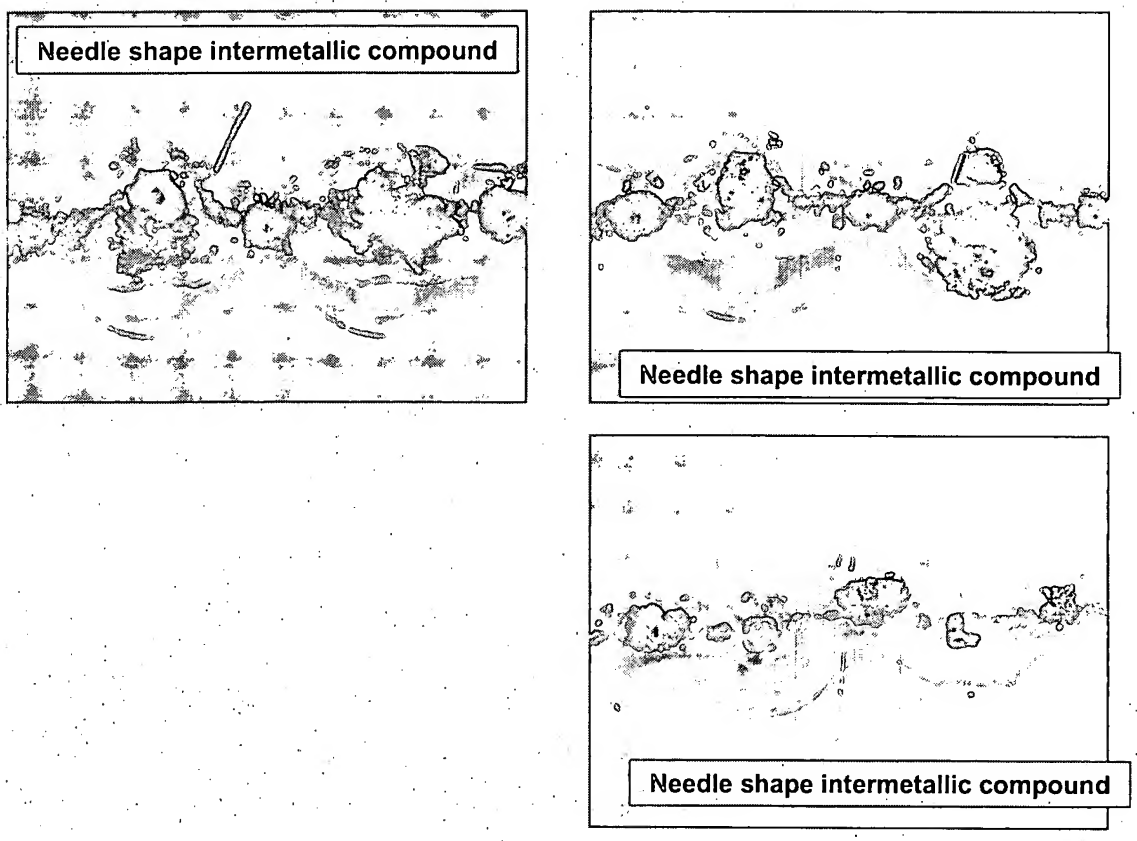
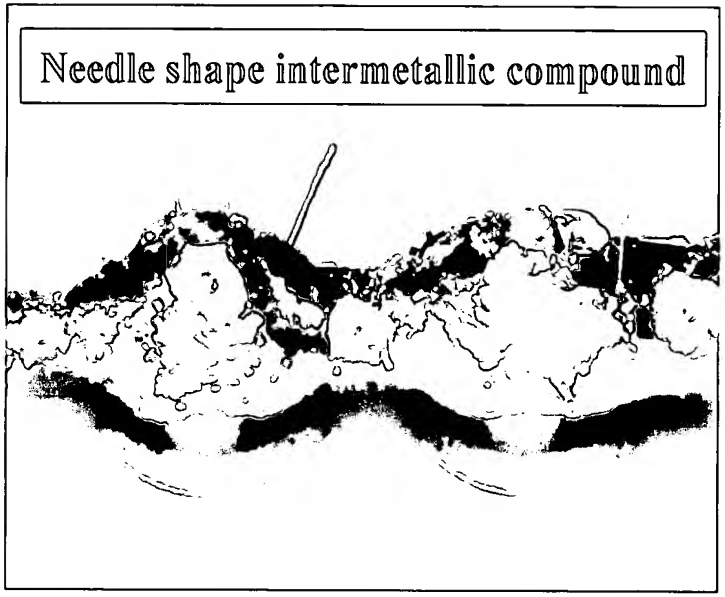
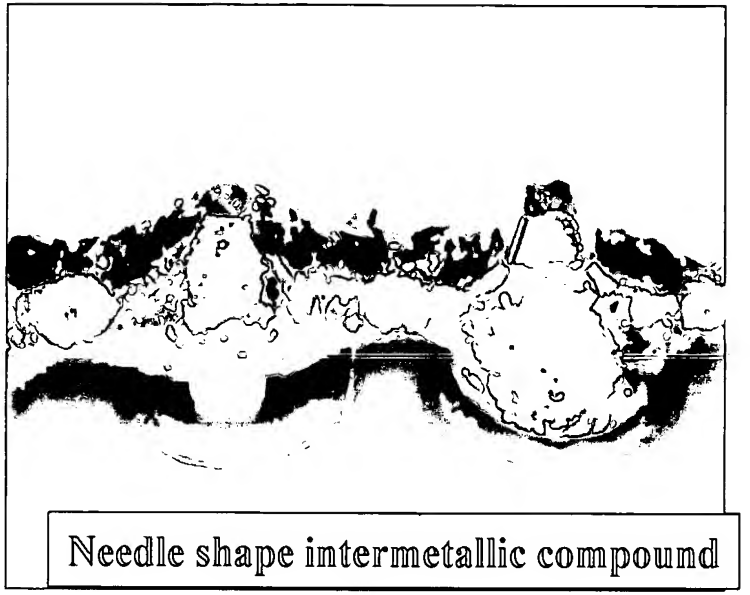


Fig.5 Exposed intermetallic compound (Lquidus 412 deg.C)





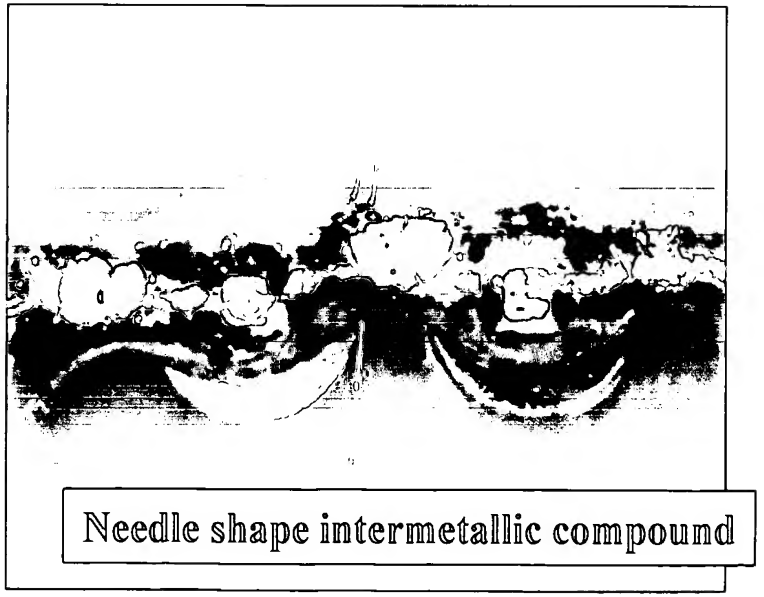


Fig. Exposed intermetallic compound (Sn-2.5Cu-0.05Ni-0.003P)

Problems of ≥ 0.5% Ni in JP 10-144718

- Liquidus temperature becomes too high:
  Lowest liquidus temperature of
  Sn-Cu-Ni-P = 350deg.C (when Cu = 0%)

Effects of Ni content in Sn-Cu-Ni-P alloy

- Advantage: Ni increases strength
- Problem: Ni increases liquidus temperature

Effects of ≤ 0.3% Ni in present invention

- Increases strength while keeping liquidus temperature low
- Liquidus temperature ≤ 300 deg.C when Cu = 0.2% to 1.9%

Standard flow soldering temperature for IC's

- Liquidus temperature + 25deg.C to + 40 deg.C

Source: Kyocera HP, RISO KOGYO HP

Standard reflow soldering temperature for IC's

- Solder balls: liquidus + 10 deg.C
- Solder paste: liquidus + 10 deg.C
- Solder preforms: liquidus + 10 deg.C

Source: FUJITSU TEN HP, TI HP,
KONICA HP,TAIYO YUDEN HP,
ROHM HP

Heat resistance standard for IC's

- in wave soldering: 260 deg.C for 10 seconds

  Source: JEITA Roadmap 2002

- in reflow soldering: 260 deg.C MAX

  Source: JEITA Roadmap 2002 ,
  Renesas HP, OKI HP, SANYO HP,
  NEC ELECTRONICS HP etc.

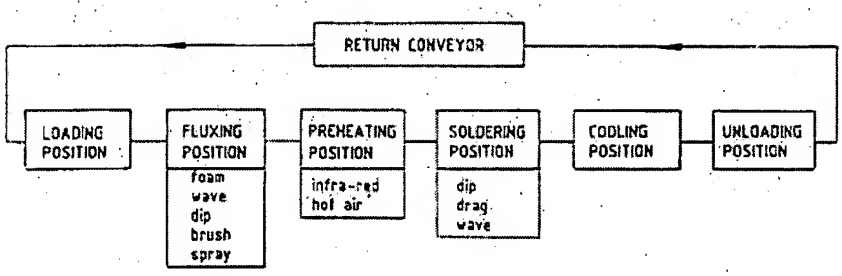
Standard reflow soldering temperature for IC's

- Liquidus temperature + 25deg.C to + 40 deg.C

Source: Kyocera HP, RISO KOGYO HP

Problems of JP 10-144718

- Liquidus temperature is too high for reflow soldering
- Liquidus temperature is too high for flow soldering
- Would cause bridging and unwetted portions in flow soldering
- Would cause needle-shaped IMC in flow soldering



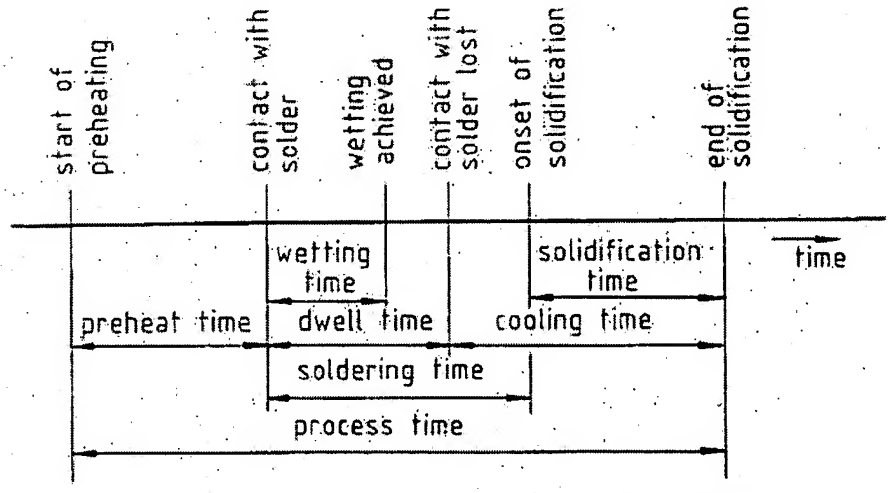


Fig. 9.2 Visualisation of the various time concepts used in machine soldering.

[Reference: Soldering in Electronics (1984 by Wassink)]

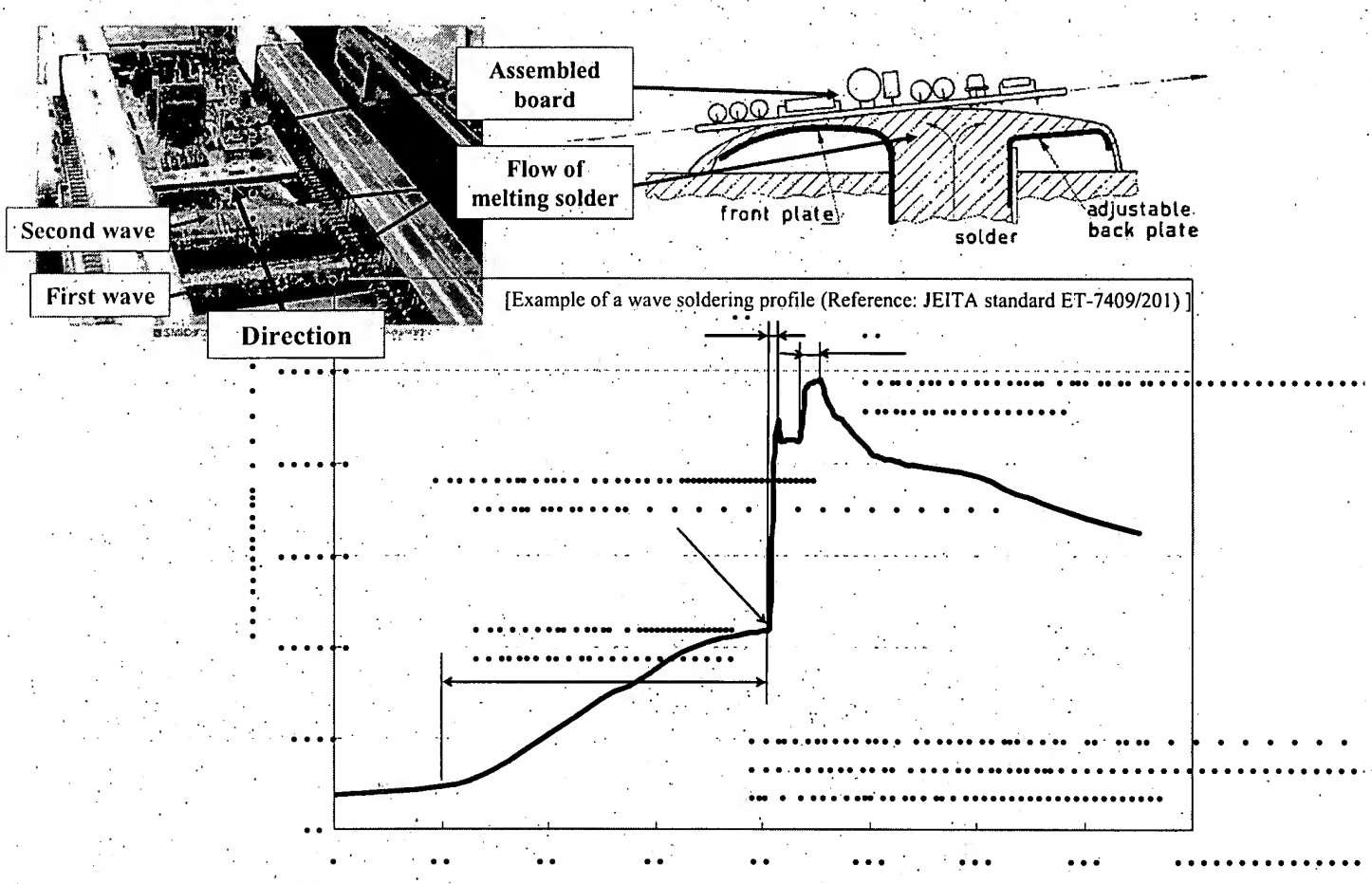


Fig. Wave soldering

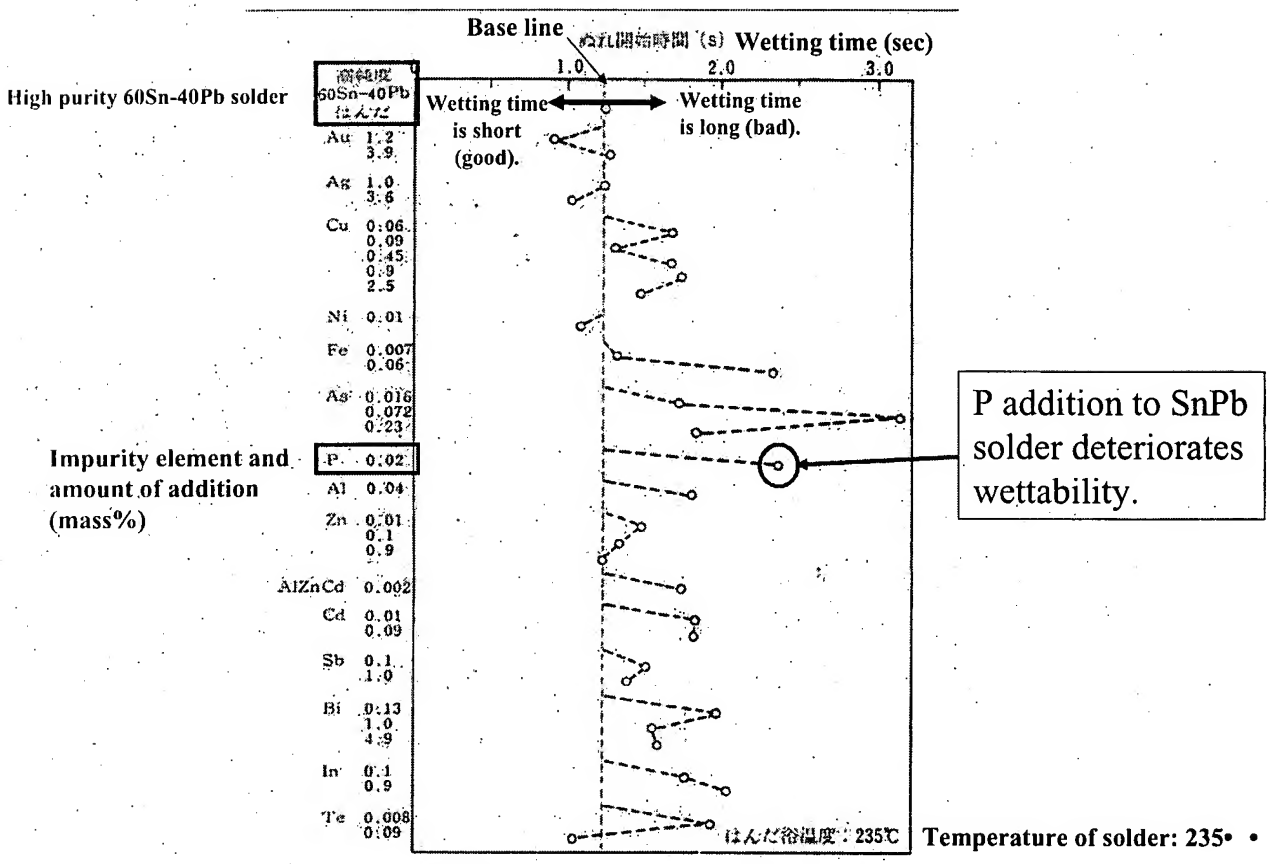


Fig 2.5 Influence of various impurity element addition to Sn-Pb solder on wetting time

Reference: Highly reliable Maicrosoldaring technology (1991 by Takemoto and Sato collaboration)

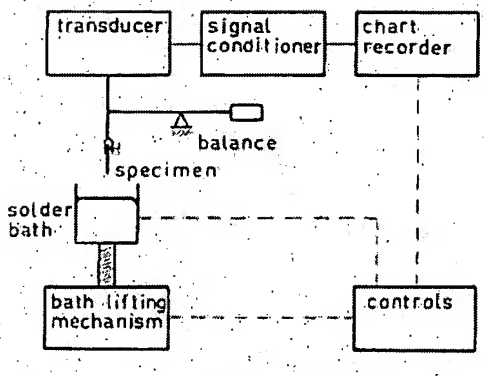


Fig. 7.3 Block diagram of wetting balance.

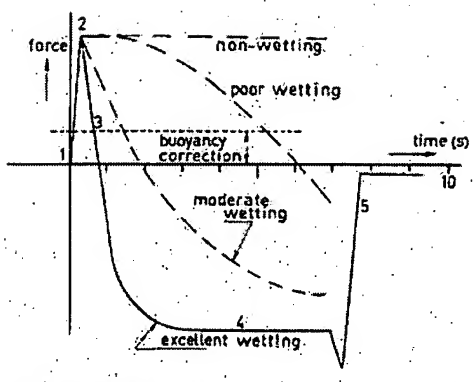
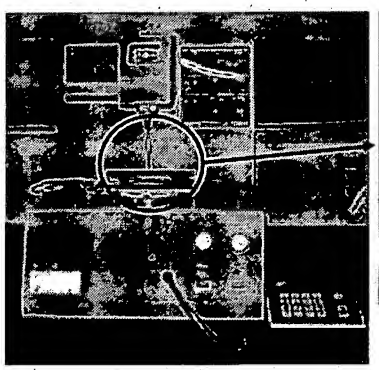
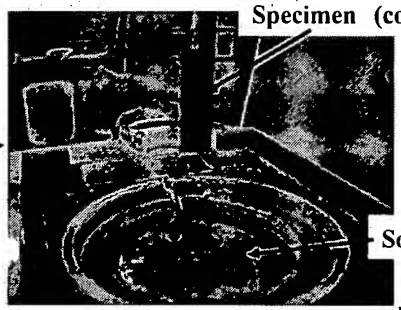


Fig. 7.5 Recorder traces of forces exerted on a specimen during the test period in a wetting balance. The figures beside the solid curve correspond to the situations shown in Fig. 7.4.



Test equipment (Made of Resca Ltd.)



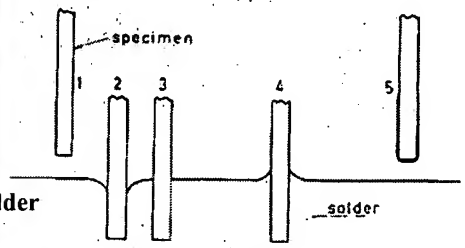


Fig. 7.4 Five situations of a readily wettable specimen in a wetting balance (see text).

Fig. Wetting Balance Method (Measurement at wetting time)

[Reference: Soldering in Electronics (1984 by Wassink)]

Possible uses of JP 10-144718

- Wire bonding - possible
  because wire bonding is performed below liquidus temperature
- Flow soldering of IC's- not possible!
  because liquidus temperature is too high
  because flow soldering must be above liquidus temperature
- Reflow soldering of IC's - not possible!
  because liquidus temperature is too high
  because reflow soldering must be above liquidus temperature

Table2 Wetting Time of Sn-Cu-Ni-P Alloy

No	Solder Composition	Wetting Time
		•sec••
1	Sn-0.05Ni-0.003P	1.63
2	Sn-0.3Cu-0.05Ni-0.003P	1.42
3	Sn-0.7Cu-0.05Ni-0.003P	1.03
4	Sn-1Cu-0.05Ni-0.003P	1.11
5	Sn-1.5Cu-0.05Ni-0.003P	1.81
6	Sn-2.0Cu-0.05Ni-0.003P	2.05
7	Sn-2.5Cu-0.05Ni-0.003P	2.56

Fig. Relation of content of Cu and Ni
(For 300deg.C in Liquidus)